

# Dismounted Infantry Simulator

## Validation Checklist



6 February 1991

FINAL DRAFT

PERCEPTRONICS, INC.

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# SIMNET

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## PERCEPTRONICS

## **PREFACE**

### **SIMNET: Advanced Technology for the Mastery of War Fighting**

SIMNET is an advanced research project sponsored by the Defense Advanced Research Projects Agency (DARPA) in partnership with the United States Army. Currently in its third year, the goal of the program is to develop the technology to build a large-scale network of interactive combat simulators. This simulated battlefield will provide, for the first time, an opportunity for fully manned platoon-, company-, and battalion-level units to fight force-on-force engagements against an appropriately scaled and realistic opposing force. Furthermore, it does so in the context of a joint, combined-arms environment, with the complete range of command and control and combat service support elements essential to combined-arms combat. All of the elements that can affect the outcome of a battle are represented in this engagement, with victory likely to go to that unit that is better able to plan, orchestrate, and execute its combined-arms battle. Whatever the outcome, combat units will benefit from this opportunity to practice collective, combined-arms, joint war fighting skills at a fraction of the cost of an equivalent exercise in the field.

While simulators to date have been shown to be effective for training specific military skills, their high costs have made it impossible to buy enough simulators to train the force fully. Further, because of the absence of a technology to link them together, they have not been a factor in collective, combined-arms, joint training. SIMNET addresses both of these problems by aiming its research at three high payoff areas, namely:

- Better and cheaper collective training for combined-arms, joint war fighting skills.
- A testbed for doctrine and tactics development and assessment in a full combined-arms, joint setting.
- A "simulate before you build" development model.

These payoffs are achievable because of recent breakthroughs in several core technologies that have been applied to the SIMNET program, including:

- High speed microprocessors.
- Parallel and distributed multiprocessing.
- Local area and long haul networking.
- Hybrid depth buffer graphics.
- Special effects technology.
- Unique fabrication techniques.

These technologies, applied in the context of "selective fidelity" and "rapid prototyping" design philosophies, have enabled SIMNET development to proceed at an unprecedented pace, resulting in the fielding of the first production units at Fort Knox, Kentucky, just three years into the development cycle.

In addition to the basic training applications, work is underway to apply SIMNET technology in the area of combat development to aid in the definition and acquisition of weapon systems. This is made possible because of the low cost of the simulators, the ease with which they can be modified, and the ability to network them to test the employment of a proposed weapon system in the tactical context (i.e., within the context of joint and combined-arms setting).

Work on SIMNET is being carried out by co-contractors Bolt Beranek and Newman, Inc. (BBN) and Perceptronics, Inc. Perceptronics is responsible for training analysis, overall system specification, and the physical simulators, and BBN is responsible for the data communication, computer-based distributed simulation, semi-automated forces, and the computer image generation (CIG) subsystems. The project is a total team effort.

DARPA is the DoD agency chartered with advancing the state-of-the-art in military technology by sponsoring innovative, high-risk, high-payoff research and development.

## INTRODUCTION

### Background

This document contains two parts:

1. A completed Validation Checklist that summarizes the currently-implemented functionality of the SIMNET Dismounted Infantry (DI) Simulator, and
2. A Physical Configuration Checklist, listing all physical components of the DI Simulator.

### Validation Checklist

The DI Validation Checklist is intended be used by the Government to validate the deliverables under the SIMNET Bridge contract. The Checklist was developed by the authors of the DI Simulator Functional Specification (dated 23 February 1990). The authors reviewed the currently-implemented DI Simulation to determine which functions had been fully or partially implemented, and which functions remained to be implemented.

SIMNET is a research and development program, as compared with a system procurement program. A SIMNET functional specification provides guidance for the developers, and is not considered a system specification. Thus, the system as actually implemented may vary from the description provided in the functional specification; however, all functions are intended to be fully developed.

Each checklist item in the DI Validation Checklist has four parts. The first part is the title or name of the function. Each title is phrased as an action statement so that the reviewer can ask "Was this functionality implemented, yes or no."

The second part of each Checklist item is the "Criterion" statement that provides a more detailed description of the required functionality, and can be used by the evaluator in determining if the functionality has been implemented.

The third part is the "Status". There were only four status statements used in the development of this document: Implemented, Partially Implemented, Not Implemented, and TBD.

"Implemented" means that, in the opinion of the designers, the simulation functionality identified in the DI Functional Specification has been implemented. Functions labeled "implemented" have been tested and verified by the designers.

"Partially Implemented" means that only certain portions of the specified functionality was implemented. Certain elements necessary for the complete functional capability have not been developed or installed; these missing items are explained in the subsequent "Comments" section.

"Not implemented" is self explanatory. Note that for those cases where a feature was not implemented as of the writing of this document, but is still under development, an appropriate note was inserted in the "Comments" section.

"TBD" (To Be Determined) means that the function remains to be validated.

The last part of each Checklist item is the "Comments" section that is used to clarify any deviations from the implemented functional capability with the requirements in the functional specification.

#### Physical Configuration Checklist

The DI Physical Configuration Checklist is provided as a major component listing of the DI simulator.

## **DISMOUNTED INFANTRY VALIDATION CHECKLIST**

### **1 Deploy In A Tactical Manner.**

#### **1.1 Operate as DI Squad Leader.**

**Criterion:** The DI operator can function as a Mechanized Infantry Squad Leader and control the remainder of the squad's movement, vulnerability and fire power through interaction with the simulation controls.

**Status:** Implemented.

**Comment:** None.

#### **1.2 Operate as DI Platoon Leader.**

**Criterion:** The DI operator can function as a Mechanized Infantry Platoon Leader and control the remainder of the platoon's movement, vulnerability and fire power through interaction with the simulation controls. The DI operator will have SAF DI squads attached or assigned to perform this function. The SAF DI squads will be attached or assigned by the SAF Commander through interaction with the SAF Workstation. The SAF DI squads will emulate the actions of the simulator-controlled DI squad (by interpreting the network packets).

**Status:** Not Implemented.

**Comment:** SAF DI are not developed at this time; therefore, the highest level of command is the Squad Leader.

### **1.3 Operate as DI Company Commander.**

**Criterion:** The DI operator can function as a Mechanized Infantry Company Commander and control the remainder of the company's movement, vulnerability and fire power through interaction with the simulation controls. The DI operator will have SAF DI squads attached or assigned to perform this function. The SAF DI squads will be attached or assigned by the SAF Commander through interaction with the SAF Workstation. The SAF DI squads will emulate the actions of the simulator-controlled DI squad (by interpreting the network packets).

**Status:** Not Implemented.

**Comment:** SAF DI are not developed at this time; therefore, the highest level of command is the Squad Leader.

### **1.4 Change Platoon or Company Formations.**

**Criterion:** When the DI operator is functioning as the Platoon Leader or Company Commander, DI operator will have the capability to change unit formations from Line to Column and from Column to Line.

**Note:** Selection of Line or Column will not effect the visual display of the squad DI icon.

**Status:** Not Implemented.

**Comment:** This capability is not necessary until SAF DI are available.



## **2 View the Battlefield.**

### **2.1 Squad Views Battlefield.**

**Criterion:** The DI operator will have a horizontal instantaneous field of view of 180° of the possible 360° available. The DI operator will have a vertical instantaneous field of view of 13° of a possible +55° to -45° available. The view displayed (Squad Unity View) will represent not only the squad leader's view of the battlefield, but the squad's orientation (i.e., squad's axis of movement), and the squad's weapon orientation. The viewing range will be 3500 meters.

**Note:** The DI squad 's orientation, weapon orientation and axis of movement are always coincident.

**Status:** Implemented.

**Comment:** None.

### **2.2 Commander Views Battlefield - Unaided Optically.**

**Criterion:** The DI operator can view the battlefield with an independent viewing option that has the same visual characteristics as the Squad view. However, this option allows the commander to view the battlefield without reorienting the squad or its weapons. This view is the Commander's Unity View.

**Note:** DI Squad movement and weapons engagements will be disabled when this view is displayed. The function emulates the squad leader's head movement on the battlefield, and does not reorient the entire DI squad.

**Status:** Implemented.

**Comment:** None.

### **2.3 Commander Views Battlefield With Binoculars.**

**Criterion:** This option provides the DI operator with a binocular (7X) view of the battlefield. The DI operator can view horizontally 360°, and vertically to an elevation of +55° and a depression of -45° with an instantaneous field of view of 3° horizontal by 1.85° vertical. This option allows the commander to view the battlefield without reorienting the squad or its weapons. This view is the Commander's Binocular View.

**Note:** DI Squad movement and weapons engagements will be disabled when this view is displayed. The function emulates the squad leader's head movement on the battlefield, and does not reorient the entire DI squad.

**Status:** Implemented.

**Comment:** None.

### **3 Squad Will Be Represented Visually On The Battlefield.**

**Criterion:** The DI icon will represent an Infantry squad and be visible by all entities of the SIMNET battlefield.

**Status:** Implemented.

**Comment:** The Functional Specification described a three man icon but a single man icon was implemented.

#### **4 The Posture of the Squad Will Be Represented On The Battlefield.**

##### **4.1 Standing, Kneeling, and Prone Postures Will Be Represented.**

**Criterion:** A distinct DI icon will be used to represent each of three postures of the DI squad, which are standing, kneeling and prone. The vulnerability of the DI squad will be adjusted to be appropriate to the posture represented.

**Note:** The posture of the DI squad determines the vulnerability, movement rate, and eye point height of the simulation.

**Status:** Implemented.

**Comment:** None.

##### **4.2 "DIG IN" Posture Will Be Represented.**

**Criterion:** The DI operator will have the ability to DIG IN. There will be a time delay of 20 minutes after initiation of the DIG IN feature before the icon of the DI squad will change (i.e., prone icon will be displayed) and the vulnerability of the squad will be reduced.

**Status:** Partially implemented.

**Comment:** When Dig In is selected, the prone position, the vulnerability and movement rates associated with the prone position, are available without the specified 20 minute delay.

**5 Squad View Point Correlated To Squad Posture.**

**Criterion:** The visual eyepoint of the DI squad will be adjusted as appropriate to the posture selected. There will be three viewing heights available as indicated in the table below:

VIEWING HEIGHT TABLE		
DI POSTURE	ICON HEIGHT	VIEW POINT HEIGHT
STANDING	65"	70"
KNEELING	36"	55"
PRONE	11"	40"
DEAD	1 Pixel	None

**Status:** Implemented.

**Comment:** None.

**6 The DI Squad Moves On Battlefield.**

**Criterion:** The DI squad will be able to traverse the SIMNET terrain forward, backward, translate left, translate right, pivot left and pivot right. As the DI squad moves across the SIMNET database, the Out-The-Window (OTW) views will be updated in real-time.

**Status:** Implemented.

**Comment:** None.

## 6.1 Movement Rate Correlated To Squad Posture.

**Criterion:** The DI movement rates will be adjusted as appropriate to the posture selected. The maximum speeds for the squad, predicated on squad posture will be:

POSTURE TABLE			
DI POSTURE	ICON HEIGHT	VIEW POINT HEIGHT	MAX SPEED
UP (Standing)	65"	70"	5.3 MPH
DOWN (Kneeling)	36"	55"	1.0 MPH
DIG IN (Prone)	11"	40"	0.5 MPH
DEAD	1 Pixel	None	0.0 MPH

**Status:** Implemented.

**Comment:** None.

## 6.2 Movement Rate Correlated To Unit Formation And Terrain Type.

**Criterion:** When the DI operator is functioning as the Squad Leader, Platoon Leader or Company Commander, DI operator will have the capability to change unit formations from Line to Column and from Column to Line. These formations will effect the maximum speed available, as will the type of terrain being traversed. However, selection of Line or Column will not effect the visual display of the squad DI icon. The maximum movement rates (mph) in a Column formation will be:

Column Formation Table				
DI Position	Terrain		Water	
	Flat	Hilly	Fordable	Unfordable
Up				
First 1600 Meters	5.3	3.5	0.3	0.0
After 1600 Meters	2.5	1.6	0.3	0.0
Down	1.0	1.0	0.3	0.0
Dig In	0.5	0.5	0.0	0.0

The maximum movement rates (mph) for a Line formation will be:

Line Formation Table				
DI Position	Terrain		Water	
	Flat	Hilly	Fordable	Unfordable
Up				
First 1600 Meters	3.5	2.3	0.3	0.0
After 1600 Meters	1.6	1.1	0.3	0.0
Down	1.0	1.0	0.3	0.0
Dig In	0.3	0.3	0.0	0.0

**Status:** Not Implemented.

**Comment:** Formations, formation changes, fatigue, and terrain reasoning are not developed. The current DI squad movement rate is the same as Column on flat terrain.

### **6.3 Observe Azimuth Orientation.**

**Criterion:** The DI operator can use the azimuth indicator to determine the orientation of the selected view - Squad Unity View, Commander's Unity View, or Commander's Binocular View.

**Status:** Implemented.

**Comment:** None.

### **7 Initialize DI Simulator.**

**Criterion:** The DI simulator will be capable of being initialized in one of three ways:

- By the SAF Workstation as a single squad or with SAF squads assigned
- By the MCC as a stand alone squad
- By the MCC with SAF DI squads attached

**Status:** Not Implemented.

**Comment:** These initialization options have not been implemented. The DI simulator has to be initialized by the site technicians. Once the simulator is initialized, it behaves as if it was initialized by the MCC as a stand alone squad.

### **7.1 Initialize DI Simulator from SAF Workstation.**

**Criterion:** When the DI simulator is to be initialized by the SAF Workstation, the SAF operator will assign SAF DI squads to be commanded by the DI simulator. The purpose of this capability is to allow the SAF Commander to command, or assign someone to command, the SAF Dismounted squad or squads "hands on" as the DI operator; to be able to actually view the battlefield (i.e., as the DI operator); and to directly control the movement and engagements of SAF DI squads. This capability allows the SAF Commander to select a level of command that he determines is necessary - squad, platoon, or company. When a particular element is to be selected for activation as a DI simulator instead of an SAF squad, then the DI simulator will replace the SAF squad on the battlefield, with the same parameters as the SAF squad. The location, orientation, posture, and tactical situation will be that of the SAF squad prior to the point that the DI simulator replaced it.

**Status:** Not Implemented.

**Comment:** SAF DI are not developed therefore this capability has not been implemented.

### **7.2 Initialize DI Simulator from Battlemaster Station (MCC).**

**Criterion:** When the DI simulator is initialized from the MCC, the DI operator will have several options for level of command. Normally, the DI simulator will be a single squad, or the DI simulator can have SAF DI squads attached to it. When SAF are attached to the DI simulator, the DI simulator will not replace an SAF element or level of command, but will become an additional squad that leads the selected SAF unit. The SAF squads will assume the same configuration parameters of the DI simulator.

**Status:** Not Implemented.

**Comment:** The MCC has not been modified to accommodate the initialization of the DI simulator. The site technicians must initialize and reconstitute the simulator at the host computer.



## **8 Mount And Dismount Supporting Vehicles.**

### **8.1 Mount Supporting Vehicle.**

**Criterion:** The DI squad will be able to mount the supporting vehicles of its unit. These vehicles can be manned simulators or SAF vehicles. To accomplish this, the DI squad must be within 20 meters of the desired vehicle; if the squad is beyond 20 meters, mounting cannot occur. The DI squad will be displaced from its present position into the vehicle, and the DI icon will disappear from the database. The normal OTW views of the DI simulator will be replaced with cupula views of the attached vehicle and all indicators in the DI simulator will extinguish. The DI operator will be able to manipulate the OTW views the same as if dismounted, however all weapons systems will be disabled. While mounted, if the vehicle becomes disabled or destroyed, the DI squad will be able to dismount and continue the mission.

**Status:** Implemented.

**Comment:** None.

### **8.2 Dismount Supporting Vehicle.**

**Criterion:** The DI squad will be able to dismount the supporting vehicles of his unit. When the DI squad dismounts, it will be placed on the ground, 10 meters to the rear of, and oriented on, the supporting vehicle. The DI icon will appear on the data base in a stationary standing posture, in column formation, with "ATGM" weapon selected, and with squad unity view displayed on the OTW monitors.

**Status:** Implemented.

**Comment:** None.

## **9 Designate Target.**

**Criterion:** The DI operator will not aim any weapon system, he will only designate the area of engagement for the DI squad(s). The designation function will select and service the designated target to emulate the DI squad leader commanding his squad.

**Status:** Implemented.

**Comment:** None.

### **9.1 Engage With Small Arms Weapons.**

**Criterion:** The small arms ammunition will be an aggregate round of the small arms capability of the infantry squad. The ballistics modelled will be a 7.62 mm but the weapons effects will account for the fire power of the entire squad. This round will approximate the effects of all small arms in the squad, to include hand grenades, claymores, rifles, launched grenades and automatic rifles / light machineguns. Upon target designation (i.e., via a single depression of the trigger), the simulation will begin a 20 second fire fight.

**Status:** Implemented.

**Comment:** The ballistic characteristics of the 5.56 mm ammunition was modelled instead of the 7.62 mm. The weapons effects simulate the M-16 and SAW.

### **9.2 Engage with ATGM Weapon.**

**Criterion:** The ATGM munition will be a modified TOW weapon from the M2. The missile will have the same parameters as the TOW except it will be limited to minimum range of 65 meters and maximum range of 1000 meters.  $P_h$  and  $P_k$  for all SIMNET entities will be the same as the TOW parameters. Upon target designation, the simulation will then launch and guide the missile to the target.

**Status:** Implemented.

**Comment:** None.

### **9.3 Engage Targets In Coordination With SAF Units.**

**Criterion:** If SAF DI squads are assigned or attached to the DI simulator, the SAF DI squads will engage the same target area that the manned DI squad engages. The SAF DI squads will also engage other SIMNET elements that have fired upon the SAF DI squads.

**Status:** Not Implemented.

**Comment:** SAF DI are not implemented at this time.

### **9.4 Determine Ammunition Status.**

**Criterion:** The DI operator can determine the status of DI ammunition via a display in the DI simulator.

**Status:** Implemented.

**Comment:** None.

### **9.5 Realistic Ammunition Expenditure.**

**Criterion:** The DI squad will expend ammunition in a realistic manner. Small arms engagements will deplete either 10 % (low rate) or 30 % (high rate) of the remaining ammunition per engagement. ATGM engagements will deplete individual rounds.

**Note:** Small arms ammunition is indicated in percent of ammunition remaining and ATGM ammunition is indicated by individual rounds.

**Status:** Implemented.

**Comment:** None.

## **10 Resupply Dismounted Squad.**

**Criterion:** The DI operator will have the ability to resupply ammunition to the DI squad. There will be no OTW visual representation of this action. DI resupply will not be unit dependent. The vehicles that provide the ammunition to the DI simulator will not have to be identified as supporting the DI element. It will be assumed, for this simulation, that any friendly vehicle within 200 meters of the DI element is either attached or assigned to the same unit as the DI simulator. Ammunition resupply will not be effected from any OPFOR vehicle.

**Note:** The normal resupply is two ATGM and 100% small arms.

**Status:** Implemented.

**Comment:** None.

### **10.1 Resupply With ATGMs .**

**Criterion:** ATGMs will be the only ammunition tracked round for round in the DI simulation. ATGMs will be transferred from a supporting M2 (BMP) vehicle, if the vehicle has ATGMs available. ATGMs for the DI squad will be DRAGON missiles. When the transfer occurs, the M2 will be decremented by the number of missiles moved, and the DI simulator will be incremented by the same number. The maximum transfer will be two missiles, but if only one is available, then one will be transferred. If the supporting vehicle does not have any DRAGONS available, the simulation will determine if any vehicle within 200 meters has the missiles and if so, will transfer missiles from that vehicle to the DI simulator. If the DI squad is not within 200 meters of any vehicle, no resupply operation will take place. If there are vehicles within 200 meters, but there are no ATGMs available, only small arms will be resupplied.

**Status:** TBD.

**Comment:** Not yet validated by Perceptronics.

## **10.2 Resupply With Small Arms.**

**Criterion:** Small arms will not be tracked as an accountable item. When the DI operator requests resupply, that request will be honored (i.e., full resupply with small arms will occur), if there is a vehicle available within 200 meters.

**Status:** Implemented.

**Comment:** None.

## **10.3 Resupply While Dug In.**

**Criterion:** When the DI squad has fortified its fighting position by digging in, the squad can stockpile 200 % of small arms and four ATGMs by requesting additional resupply of ammunition. The normal resupply parameters will apply.

**Status:** Not Implemented.

**Comment:** The ability to stockpile ammunition in the Dig In configuration is not implemented.

## 11 Realistic DI Vulnerability.

**Criterion:** When the DI squad (i.e., squad bounding volume) is struck by incoming ordinance, a casualty assessment will be made. The vulnerability tables for the DI simulator will be the same as for an SAF DI squad. There will be no damage models for the DI squad - either the whole squad is alive or dead. The following will be the Probability of Kill table for the Dismounted Infantry squad:

Weapon	$P_k$	Posture		
		Up	Down	Dug In
SABOT	0	0	0	0
HEAT	15	0	0	0
25/30 MM	30	15	5	
ATGM	30	15	10	
SMALL ARMS	30	15	10	
ARTILLERY	50	25	15	
A/C CANNON	40	20	10	
BOMBS	70	35	20	

**Status:** Not Implemented.

**Comment:** New probability of hit tables were developed to accommodate this function.

## **12 Clear Minefields With DI Squad.**

**Criterion:** If the DI operator sees a minefield, he will radio the Combat Engineer (at the Combat Engineer Console) to request clearing of the minefield. The minefield will be cleared if one of the following two conditions exist: (a) the Combat Engineer assets are available to travel to the requested location, or (b) The MCC can confirm that Dismounted Infantry are at the location of the minefield. If one of these conditions exists, the MCC will initiate the mineclearing activity. The MCC will cease mineclearing operations if the DI unit that is clearing the minefield (if Engineer support is not available), becomes a mounted element, relocates, or dies.

**Status:** Partially Implemented.

**Comment:** Option B is not implemented.

## **13 Communicate With Other SIMNET Entities.**

**Criterion:** The DI operator will be able to communicate with other SIMNET entities.

**Status:** Implemented.

**Comment:** None.

## **14 Hear The Battle.**

**Criterion:** The DI operator will be able to hear all standard SIMNET battlefield sounds, including vehicle sounds, weapons fired by others, and own weapons fired (small arms and ATGM).

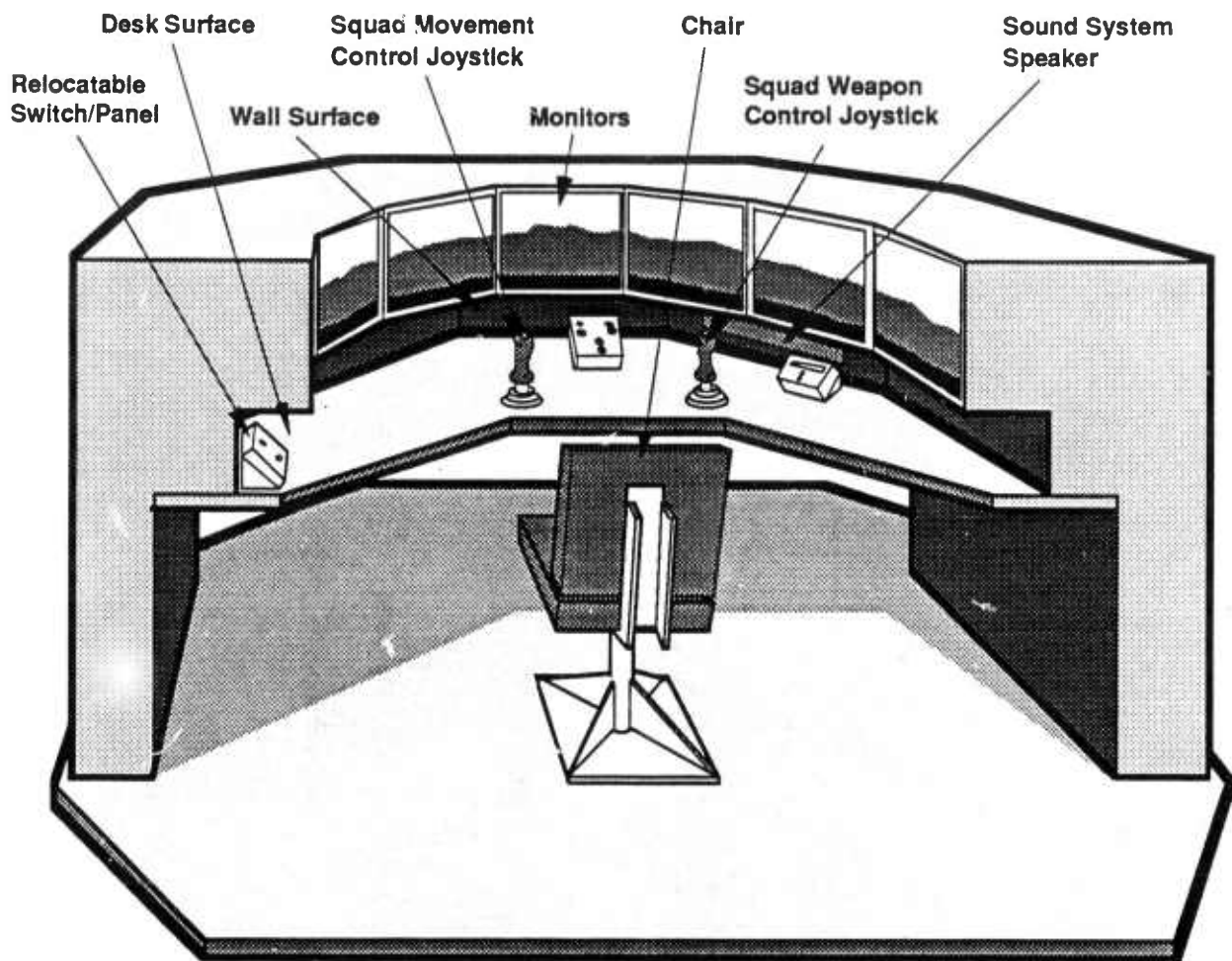
**Status:** Implemented.

**Comment:** None.

## **APPENDIX A**

### **DISMOUNTED INFANTRY SIMULATOR PHYSICAL CONFIGURATION CHECKLIST**





Dismounted Infantry Simulator

**MAJOR COMPONENT LISTING**  
**Dismounted Infantry Simulator**  
**205500**

Quantity	Component	Part Number
1	Electronics Rack	205520
1	CIG	GT 101
1	CCA, Dismount Personality	205570
1	CCA, Dismount Radio Interface	205510
1	Radio, CB, Cobra	110101
1	Cable Assembly, Headset	205531
1	Cable Assembly, Radio Microphone	205528
1	Cable Assembly, Radio Power	205527
1	Foot Switch Assy, Gunner	210590-1
1	Headset, Sony	110067
2	Speaker	110082
2	Cable Assembly, External Speaker	205529
2	Control Assembly, Handle	205590
1	Cable Assembly, Right Handle	205532-2
1	Cable Assembly, Left Handle	205532-1
1	Seat Assembly, Dismount	205525
1	Panel Assembly, DI Dismounting	205535
1	Panel Assembly, Azimuth/Ammunition	205550
1	Panel Assembly, DI Configuration	205540
1	Harness Assembly, Personality/IDC	210920
1	Harness Assembly, Power Turret	210930-21
2	Monitor Masking	205563-1
5	Monitor Masking	250563-2
1	CCA, IDC	110093
1	Cable Assembly, RS232	110098
7	Monitor, RGB, 12 ", Sony	110151
7	Cable Assembly, Video 25 f.	210900-25